of the Times will be diſcovered, which will ſerve for ever afterwards as a Rule to adjuſt the Obſervations.

The only View that I have in communicating this Paper, and in computing the Eclipſes for Time to come, is to encourage thoſe Perſons, who will find their Advantage in it, to make Uſe of this Help for obtaining the Longitude at Sea, till better Methods are offered.

V Experiments *and* Obſervations *upon the* Light *that is produced by communicating* Electrical Attraction *to animal or inanimate Bodies, together with ſome of its moſt ſurpriſing Effects; communicated in a Letter from Mr.* Stephen Gray, *F. R. S. to* Cromwell Mortimer, *M. D. R. S. Secr.*

SIR, *Charter-Houſe, Jan.* 28th, 1734-5.

IT is now ſome Months ago that I promiſed to give the *Society* an Account of what Experiments I had then made; but ſoon after there occurr'd to my Thoughts ſeveral others, which I was willing to try the Succeſs of; which Experiments requiring an Addition to the *Apparatus*, that I might make them more compleat, I hope will be a ſufficient Apology for this Delay.

I ſee you have publiſhed Mr. *Dufay*'s Letter to the Duke of *Richmond*, in the *Philoſophical Tranſactions,*

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actions, No 431. 'tis no ſmall Satisfaction to me, that my Electrical Diſcoveries have not only been confirmed by ſo judicious a Philoſopher as Mr. *Dufay*; but that he has made ſeveral new ones of his own, more eſpecially that important luciferous one, which put me upon making the Experiments I am now going to relate.

I ſhall firſt give ſome Account of the Experiments made the laſt *Spring*, ſoon after I received the Tranſlation of Mr. *Dufay*'s Letter; then of thoſe we made at my honoured Friend's, *Granvill Wheler*, Eſq; *F.R.S.* in the Months of *July* and *Auguſt*; and laſtly proceed to thoſe I have made ſince my Return to *London*, which was in *September* laſt.

As I had not any ſilk Lines by me ſtrong enough to bear the Boy, I cauſed him to ſtand on ſome of the Electric Bodies; and, as I concluded, found the Effect the ſame as mentioned by Mr. *Dufay*. I ſhall not need to mention the Particulars of the Experiment, but proceed to thoſe that were ſuggeſted to me upon Mr. *Dufay*'s ſaying, that theſe Snappings or Sparks are not excited, if a Piece of Wood, or any other Subſtance than a living Body, be paſſed over the Perſon ſuſpended on the Lines, unleſs it be a Piece of Metal: From thence I concluded, that if I ſuſpended the Metal upon ſilk Lines, or laid it upon any of the Electric Bodies, the Effect muſt be the ſame, when the Metal had been made Electrical by the Tube, and the Hand of any one was held near it, and found it ſucceeded accordingly. I began firſt with ſome common Utenſils that were at Hand, ſuch as the Iron Poker, Tongs, and Fire Shovel; any of theſe being ſuſpended upon Lines of the largeſt ſewing Silk then the excited Tube, being applied firſt to the Knob of the Poker, and after it the Hand, there was the Snap and Pricking felt, as I expected; and the Effect was the ſame, when the Tube was firſt applied to the other End of the Poker. I had by me a three pronged Iron Inſtrument, which was made many Years ago; its Uſe was deſigned for propping up the Obſervatory Table, when I obſerved the Spots in the Sun; the Prongs were about half an Inch Diameter, two of them about 22 Inches, and the third about 8 Inches long; they were tapering towards the Ends, and pointed: this being laid either upon Cylinders of Glaſs, Cakes of Roſin and Bees Wax, or on a Cake of Sulphur, the Tube being applied to the End of any of the Legs, the Hand or Cheek being applied near the other, both the other Legs had the ſame Effect as that to which the Tube had been applied; but by holding my Cheek near any of the Points of the Legs, the pricking or burning Pain was much more ſenſibly felt, and was ſometimes felt for ſeveral Minutes after. I was not ſo inquiſitive at that Time about making the Experiment in the Dark, that I might ſee the Light proceeding from the Iron, not thinking the Electricity communicated to the Metals would have produced ſo ſurpriſing Phænomena, as by the following Account of the Experiments will be deſcribed.

1. I come now to give ſome Account of the Experiments we made at Mr. *Wheler*'s, beginning firſt with the Succeſs we had in repeating Mr. *Dufay*'s Experiment. Mr. *Wheler*, ſoon after my coming to him, procured ſilk Lines ſtrong enough to bear the Weight of his Footboy, a good ſtout Lad; then having ſuſpended him upon the Lines, the Tube being applied

applied to his Feet or Hands, and the Finger of any one that ſtood by held near his Hands or Face, he found himſelf pricked or burnt, as it were by a Spark of Fire, as Mr. *Duſay* had related, and the ſnapping Noiſe was heard at the ſame Time; but it did not ſucceed with us, when we applied our Hands to any part of his Body through his Cloaths, except upon his Legs, upon which he felt the Pain through his Stockings, although they were very thick ones.

2. Being deſirous to make the Experiment upon another Species of Animals, we took a large white Cock, and ſuſpended him upon the Lines firſt alive, and the Effect was the ſame as on the Boy, whether we applied our Fingers to any Part of his Body, or our Cheek to his Beak, Comb or Claws; then the Cock was killed, and put on the Lines again, and we found very little, if any, Difference, from the Effect it had on us when the Cock was living: We then cauſed the Cock to be ſtripped of his Feathers, and the Difference from what has been ſaid before was not very great.

3. We took a large Sirloin of Beef, that came from an Ox that had been killed two Days before, and ſuſpended it on the ſilk Lines; then the Fingers held near any Part of it, there was a Snapping, and the Fingers were puſhed or pricked; but the Snapping was thought not to be quite ſo loud as when the Experiment was made on the Cock.

4. We cauſed to be made an Iron Rod, 4 Foot long, and about half an Inch Diameter, pointed at each End, but not ſharp, being left about the Bigneſs of a Pin's Head, this being ſuſpended on the Lines; then the Tube being rubb'd, and held near one End of the

Rod,

Rod, and then the Finger or Cheek being put near either End of the Rod, the Effect was the ſame as when an Animal had been ſuſpended on the Lines, with reſpect to the pricking Pain we felt.

5. At Night we made the luminous Part of the Experiment, ſuſpending the Iron Rod on the ſilk Lines; then applying one End of the Tube to one End of the Rod, not only that End had a Light upon it, but there proceeded a Light at the ſame Time from the other, extending in Form of a Cone, whoſe Vertex was at the End of the Rod, and we could plainly ſee that it conſiſted of Threads, or Rays of Light, diverging from the Point of the Rod, and the exterior Rays being incurvated. This Light is attended with a ſmall hiſſing Noiſe; every Stroke we give the Tube, cauſes the Light to appear: the Hiſſing ſeems to begin at that End of the Rod next the Tube, and as it comes, increaſes in its Loudneſs, but it is ſo ſmall as not to be heard without good Attention, and by thoſe only that ſtand at that End of the Rod from whence the ſaid Light proceeds.

Mr. *Godfrey* being deſirous to ſee theſe Experiments, I repeated them, by laying a Rod of Iron upon a Cake of Shell-Lake, which was laid upon a Glaſs Veſſel; but the Effects being much the ſame with what has been above-mentioned, I ſhall not need to mention any other Particulars.

1. I ſhall now proceed to give ſome Account of the Experiments I have made ſince my Return to *London*, which was in *September* laſt. I cauſed three Iron Rods to be made, one of four Feet long, two, each three Feet in Length; one of theſe was made tapering toward the Ends, and pointed as that of four Feet

was; the other pointed at one End, and the other End not pointed, the Diameter of the Rods about half an Inch; they were firſt forged, then filed and burniſhed. With theſe I made the following Experiments: When any of them were laid either upon the Brims of hollow Cylinders of Glaſs well warmed, or upon Cakes of Roſin and Bees Wax, or upon thoſe of Sulphur, the Phænomenon was the ſame as when they had been ſuſpended on Silk Lines: But now I diſcover'd another very ſurpriſing one, *viz.* that after the Tube had been applied, and the Light ſeen at both Ends, upon my going to the other End of the Rod, when there was no Light to be ſeen, upon holding my Hand at ſome diſtance from it, then moving my Hand towards it with a pretty ſwift Motion, there iſſued from that Point of the Rod a Cone of Light, as when the Tube had been applied to the other End; and upon repeating this Motion of my Hand, the ſame Phænomenon appear'd for five or ſix times ſucceſſively, only the Rays were each time ſhorter than the other; theſe Lights are alſo attended with a hiſſing Noiſe: That Light which appears upon that End next the Tube, when it is held obliquely to the Axis of the Rod, has its Rays tending towards it: All the Time I am rubbing the Tube, theſe Flaſhes of Light appear upon every Motion of my Hand up or down the Tube, but the largeſt Flaſhes are produced by the Motion of my Hand downwards.

2. When two or three Rods are laid either in a right Line, or making any Angle with each other, or either touch, or are at a ſmall Diſtance from one another, the Tube being applied to one of their Ends, the furtheſt End of the further Rod; exhibits the ſame Phænomena as one ſingle.

3. An Experiment with the Rod that was pointed at but one of its Ends. When the Tube is applied to the other End of the Rod, the Point gives the ſame Appearance and alike Effect with the Rods, that are pointed at each End; but the great End of the Rod, when the Hand or Cheek is applied near it, gives but one ſingle Snap; but this is much louder than the greateſt of thoſe from the Point of the Rod, and one feels a little more Pain by it.

4. I cauſed an Iron Ball to be forged, and then turned and burniſhed; 'twas two Inches Diameter, which being placed on a wooden Stand, that had a ſmall Concave at the Top, in which the Ball was placed; the Stand being ſet upon a Cylindrick Glaſs, then the excited Tube being applied near the Ball, there proceeded a Stream of Light from it, with a ſmall hiſſing Noiſe; then putting my Finger or Cheek near the Ball, there was no Snapping, nor any Pain felt, yet there appeared a very bright Light.

5. The Rod of four Feet long, being placed upon a Stand, that had a croſs Arm with a Groove in it to receive the Rod; then the Stand being placed on the Glaſs Cylinder, they were ſet at ſuch a Diſtance, as that one of the Points of the Rod might juſt touch the Ball over againſt its Centre; then going to the other End of the Rod with the prepared Tube, and applying it as uſual, when I came to the Ball, the Hand or Cheek being near it, cauſed a loud Snap, compared to thoſe made by the Points of the Rods, and the Pain of pricking or burning was more ſtrongly felt, the Light alſo was brighter and more contracted: I then placed the Rod with its Point at an

Inch

Inch diſtance from the Ball, and applying the Rod as before, I came to the Ball, and touching it with my Hand or Finger, there not only appeared a Light on the Ball, but there alſo proceeded a Bruſh of Light from the Point of the Rod after the ſame manner as when the Experiments had been made with the Rods only.

6. An Experiment made with the four Feet Rod, and a Braſs Plate four Feet ſquare. This was placed upon a Stand, ſo that the Plate ſtood perpendicular, the Stand being ſet on the Cylindrick Glaſs; then the Rod with its Stand and Glaſs was ſet ſo as that one Point of it was about an Inch from the Centre of the Plate; then the Tube being applied to the other End of the Rod, and after going to the Plate, on ſtriking it gently with my Finger on the back Side, a Light appeared upon the Plate, and at the ſame time the Bruſh of Light came out from the Point of the Rod; and when my Hand or Cheek was held near any of the Angles of the Plate, there was a Light came from thence with a ſmall hiſſing Noiſe, and the Pricking was felt as when the Experiments were made with the pointed Rods.

7. A Pewter Plate being laid upon the Stand, which had been ſet upon a Glaſs Cylinder, the Tube firſt, and then the Finger applied, there appeared a Light upon the Plate, and the End of the Finger was puſhed; and when the Cheek was held near the Edge of the Plate, there was a Snapping heard, but not ſo loud as when the Iron Rods were uſed. I then filled the Plate with Water, and applying the Tube and Finger as before, there was the ſame Light, puſhing of the Finger, and Snapping, as when the Experiment was made with the empty Plate. When the Experiment is made with Water by Day-light, by applying the

the End of the Finger near the Surface of the Water, it appears to riſe in a little Hill, and upon the ſnapping Noiſe falls down again, putting the Water into a waving Motion near the Place where the Water had riſen.

8. I then took a wooden Diſh, and placed it upon the Stand firſt empty; then applying the Tube, and the Fin- held near the Diſh, there appeared a Light, but no puſhing of the Finger nor Snapping: I then filled the Diſh with Water, and the Tube being held over the Surface of the Water, there appeared a greater Light than when the Finger had been applied to the empty Diſh, but no Snapping, till by holding the Tube after it had been well rubbed, within two or three Inches of the Finger that was held near the Surface of the Water, and then the Finger was puſhed, and a ſnapping Noiſe heard, as when the Experiment was made with the Pewter Plate.

By theſe Experiments we ſee, that an actual Flame of Fire, together with an Exploſion, and an Ebullition of cold Water, may be produced by Communicative Electricity; and altho' theſe Effects are at preſent but in *minimis*, it is probable, in Time there may be found out a Way to collect a greater Quantity of it; and conſequently to increaſe the Force of this Electrick Fire, which, by ſeveral of theſe Experiments (*Si licet magnis componere parvâ*) ſeems to be of the ſame Nature with that of Thunder and Lightning.

S I R,

Your's and the Society's Moſt Obedient
Humble Servant,

STEPHEN GRAY.